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Biological Fitness in Man

THE WORD "FIT," as ordinarily defined in the dictionary, means "well adapted to the circumstances, in good health or condition." Lately, however, it has been acquiring a new and different specialized meaning in biology. To quote from Professor Medawar's recent Reith Lectures: "the word 'fitness,' then, has come to mean *net reproductive advantage*, and geneticists do not deliberately use it in any other sense." Originally, geneticists would usually have applied the word to particular genes rather than to the organism as a whole, but it is now being used in the sense that one individual is said to be fitter than another if, and only if, it is going to be represented by more of its descendants in future generations. Biological fitness is judged with reference to other members of the same species, and it is not concerned with the evolutionary adaptedness of the species itself, in interspecific competition.

It is rather a pity that a common English word is being taken over and given this quite different meaning by biologists, especially as its biological use probably derives from Herbert Spencer's famous phrase "the survival of the fittest", where it is used in the original non-technical sense. When in 1867 he wrote:

> Plants depend for their prosperity mainly on, air and light . . . Such of them as happen, by variations in the mode of growth, to get at all above the rest, are more likely to flourish and leave offspring than the rest. That is to say, natural selection will favour the more upright-growing forms: individuals with structures that lift them above the rest, are *fittest* for the conditions: and by the continual *survival of the fittest*, such structures must become established.

by "the fittest" he clearly meant those that were best adapted—the tallest and the strongest—which he believed would thereby be enabled to survive and leave most offspring for future generations. It would not then have been considered a contradiction in terms to suggest that the "fittest" might possibly sometimes leave fewer descendants, through infecundity or for other reasons. But as geneticists nowadays use it, the phrase "survival of the fittest" is merely tautological: the fittest are by definition those that do survive, whatever their adaptedness or fitness in the ordinary sense of the word.

Fitness to Survive

It is well known that sometimes the individuals best adapted to external conditions do *not* have the highest net reproductive advantage, and are, therefore, biologically less "fit." Deliberate human selection can produce domestic breeds which would be quite unfitted to survive in a natural environment, and sexual selection in wild animals may favour conspicuous clumsy forms, ill-adapted to life in general apart from their advantage in breeding. The same may happen when a species has become fully adapted to stable conditions, with few possibilities for further evolutionary improvement. Intra-specific selection does not then stop, but it tends to become concentrated upon other factors, especially those increasing fertility, rather than on further adaptation to the external environment.

Other things being equal, those that produce the most offspring will leave the most descendants, and so they will be preferred in selection even if in other ways they are less well adapted. The "fittest", biologically speaking, those with the highest net reproductive advantage, will be the types to survive but the competitive advantage of the species as a whole, and its fitness in intraspecific competition, may be undermined. This is perhaps the reason for one of Evolution's most general empirical Rules, that the large majority of species in the end neither survive unchanged nor evolve into something else, but become wholly extinct.

Selection in Civilized Man

In his lecture, Professor Medawar discusses

the suggestion that mankind may now be going downhill, our overall fitness undermined by advances in medicine and hygiene, and by all that goes with civilization and the Welfare State. He points out that, if by "going downhill" is meant "declining in biological fitness," the argument is self-contradictory. If what may be considered inferior types are going to increase in future generations, they will do so only if they have a higher net reproductive advantage, and so by definition they will have shown their superior biological fitness in intra-specific selection.

There are several ways in which the human stock could appear to be degenerating. First of all, as civilized man leads a physically easier life than his primitive forebears, the relative selective advantage of strength and hardiness, good eyesight and so on, will be reduced. Since selection will tend to become concentrated upon other characteristics, there is bound to be some loss where it is relaxed. Provided these other characteristics involve things like intelligence and social adaptability, however, there will be no overall loss in adaptedness at all, but a gain. There is no question here of mankind going downhill, and we would not wish to reverse the trend, even if we could.

Secondly, advances in medical technique now allow people suffering from certain specific disabilities to live more or less normal lives. Diabetes, severe myopia, even bad teeth, must once have been practically lethal but they are now no more than minor inconveniences, and doubtless others will be added to this list in the future. If those who carry such defects are otherwise competitive they may prosper and transmit their disabilities to future generations. They will have become "fit" in the biological sense of the word, at the expense of some loss in the competitive vigour and adaptedness of the species as a whole. That may not matter very much, since the defective individuals will presumably go on being able to maintain their social effectiveness by artificial means. And if some of them can make a contribution to the human cultural inheritance, the biological loss may be offset by a social gain.

Unfortunately, however, it is much easier to preserve the lives of those afflicted with hereditary weaknesses than to bring them up to full effectiveness. Further improvements are to be expected here, but it seems excessively optimistic to hope that there will ever not be some residue who would better never have been born. But although some of these may be able to reproduce, the really defective are unlikely ever to achieve a net reproductive rate to compare with the normal, and the quality of the better part of the population should not be affected, despite a decline in the average level. An increasing proportion of defectives may constitute a serious social and economic burden on the community, but it will not really be an evolutionary threat to the biological future of humanity.

Intelligence and Biological Fitness

It is not the obviously defective that are the threat: the real danger lies in the possibility that some large section of the population marginally below the average standard may gain a net reproductive advantage over the rest, and so be preferred in selection. Domestic animals show how selective breeding for a preferred type can lead to large changes in quite a short time, and not all of them are changes for the better. The same could happen in Man, with both his physical structure and his innate intelligence. Intelligence is the most important and most distinctive of human characteristics and, as it is certainly inherited genetically, it must respond to selection in evolution.

Human intelligence has evolved to its present level because the more intelligent have been biologically the fittest, and have had a net reproductive advantage over the rest. There is no reason to think that the human brain has yet reached the limit of its evolutionary potentialities and, if this selection continues, intelligence may be expected to increase still further. But equally if there is a change in net reproductive advantage, so that the less intelligent become biologically fitter and leave most descendants, the course of evolution will be diverted, and the level of intelligence will start to fall.

Any genetically inherited character is maintained in a population by a dynamic balance of selective forces, and if these change the balance changes with them, up or down. This may happen

slowly and it will be hard to detect, for there is no question of the really defective suddenly starting to outbreed the rest. The large majority of the less intelligent half of the population consists of normally useful and responsible people, but if they should ever gain a net reproductive advantage over the more intelligent half, then intelligence will start to decline and will stop doing so only if the balance of selective advantage is again reversed.

Cultural Evolution

It has often been pointed out that the evolution of human societies has taken on a new and uniquely different form, because of the non-genetical mode of inheritance of human culture and traditions. It may be true that this cultural evolution is now much more rapid, and probably more important in its effects, than is the biological evolution of the human species, but it is quite wrong to conclude from this that natural selection in human populations has ceased, or is likely to do so. Unless it is the result of intentional choice, any non-random elimination is properly to be termed natural selection, however artificial the environment in which it occurs. Until the breeding adults in each generation represent a random sample not merely of all the zygotes conceived but of all that potentially could have been conceived, this will continue to operate, and that will surely never happen.

Cultural evolution might well continue its advance while innate intelligence was declining, because of changes in the relative biological fitness of different sections of the population. It is a nice point whether we should then say that human evolution was progressing "uphill" or "downhill," but most probably it would be heading towards disaster. Some experts believe that this may already have begun, but the evidence is open to other interpretations and the question is still in dispute. At least, there is here a potential danger to the future of humanity, and one that ought to be taken seriously.

Conclusions

As our physical, biological and social environments are brought more and more under control we can no longer be content merely to applaud or deplore the course taken by human evolution, when it is possible deliberately to encourage or to check its progress. This is, of course, already being done, though quite unintentionally: medicine and education, social conventions and taxation, warfare, invention and commerce, all of these must have had important effects upon the genetical inheritance of mankind, hard though it is to determine precisely what they will have been.

Man's biological evolution will not come to an end so long as he continues to exist, but we cannot assume that it must inevitably be progressing in the most desirable direction. There is little comfort in the thought that if less desirable types are to gain a net reproductive advantage, this can only mean that they have proved their superior biological fitness in intra-specific selection. Man is beginning to gain the power, and with it the responsibility of making sure that those types which are best and fittest to survive are, in fact, the ones that *do* survive into future generations.